Response to Consultation Paper on Interconnect Usage Charges

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This is a combined response to Q1 and Q2 of the consultation:

The Relation of Traffic Balance and Network Size in the Indian Mobile Industry[1]

Assumptions on the challenges faced by small networks are often used by regulators in fixing access charges. However this relation is an empirical question that depends on the customer profiles, pricing strategies, and calling patterns of different networks at a particular point in time, in a specific context.

A panel data set provided by a sample operator (in the course of a pro bono consulting engagement) provides outgoing and incoming minutes on local calls with respect to each other operator in each circle[2] on a monthly basis from December 2007 to March 2009. More recent data could not be accessed due to confidentiality considerations. Data on the subscriber numbers of each operator comes from the Indian telecom regulator. Based on this, the relation between the traffic balance and the relative size of the subscriber bases is examined. This is done by regressing the traffic balance on intra-circle calls of different operators against their relative subscriber bases to assess whether the size of an operator has a significant positive impact on traffic balance, in the sense that large operators would inevitably run traffic surpluses vis-à-vis small networks.

The traffic balance in a circle between the sample operator and another operator is defined as the number of outgoing intra-circle minutes from the sample operator to the other operator's network as a percentage of the number of incoming minutes from the other network to the sample operator. For instance, if in the Delhi circle in March 2009, the sample operator has 150 million minutes of calls to a certain operator and 175 million incoming calls, the traffic balance is 85.7%[3]. A traffic balance below 100% reflects a deficit.

The number of subscribers of an operator is taken as the measure of operator size. We define 'Subscriber balance in a circle between the sample operator and another operator' as the number of subscribers of the other operator as a percentage of the number of subscribers of the sample operator. For instance, if in the Delhi circle the sample operator has 4 million subscribers and another operator has 5 million subscribers, the subscriber balance is 125%. Percentages are taken in order to normalize for the absolute magnitude of differences in traffic and subscribers.

The paper shows that, in line with common perception, as the size of the other network increases with respect to the size of the sample operator, the access deficit of the chosen operator

[1] Currently under review for academic publication.
[2] Note that while this data set allows us to estimate the calling pattern of a subscriber of the sample operator, in term of minutes of outgoing and incoming calls, it does not allow us to estimate the calling pattern of subscribers of other operators.
[3] Intra-circle calls comprise 84.4% of total traffic according to the PWC study in 2008. The proportion was at its lowest level of 79% in 2004. Therefore intra-circle traffic balance is a good proxy for overall traffic balance.

increases. A 1% increase in the subscriber balance, i.e. the relative size of the other network, will lead to, approximately, a 0.24% increase in traffic balance, i.e. a 0.24% increase in the ratio of outgoing to incoming minutes.

To gain an understanding of the size of this effect, suppose in Delhi the sample operator has 150 million minutes of calls to a certain operator and 175 million incoming calls. Suppose also that the sample operator has 4 million subscribers and the other operator has 5 million subscribers. Then increasing the other operator's subscribers by 40000 would increase the outgoing minutes by 400,000 minutes, involving an increased interconnect charge of Rs. 120,000. Note the monthly revenue of the sample operator in a circle like Delhi in the period under consideration would be approximately Rs. 1.2 billion.

The low R-squared suggests that a fixed effects estimation be attempted. The Fixed Effect estimation procedure suggests, that adjusting for the cross-sectional effects related to the company-circle combination, the subscriber balance is statistically significant in explaining the variation in the traffic balance over the time period from December 2007 to March 2009. The value of the beta coefficient increases from 0.24 to 0.94. In the example discussed above, increasing the other operator's subscribers by 40000 would increase the outgoing minutes of the sample operator by about 1,620,000 minutes, involving an increased interconnect charge of Rs. 486,000. The associated R-square is also high at 0.77.

If α_i the fixed effect related to the company-circle combination were not correlated with the subscriber balance, one could conclude that most of the variation in the traffic balance is explained by factors other than the subscriber balance, given the difference in the R –square of the fixed effects model and the pooled OLS model. One could go on to argue that even though the beta coefficient on size is positive, indicating larger networks have a traffic surplus, there are many factors other than size that count.

However, one of the main reasons for collecting panel data and using the fixed effects model is to allow the unobserved effect α_i to be correlated with the independent variables. If α_i is independent of the independent variables, then the random effects model would be more appropriate (the random effects model is ruled out using the standard Hausman test).

Therefore the high R-squared with the fixed effects reinforces the impact of subscriber balance on traffic balance shown by the simple OLS. Indeed, there are many company-circle specific fixed effects that are related to size, which is often an indicator of the recency of entry. Small firms that are relatively new entrants in the market need to adopt special pricing strategies and customer acquisition plans. The profile of their customers and their calling patterns may also be different from those of older entrants, especially in a market like India where the ubiquity of the mobile phone is a recent phenomenon. The analysis therefore does not allow us to conclude that size is not a relevant factor in the determination of traffic deficits in the Indian market.

With effectively only one variable in the analysis, there is a possibility of a missing variable bias. Attempts were made to expand the set of explanatory variables to include the relative number of BTS's and the relative holding of spectrum, in addition to the subscriber balance. The hypothesis being tested was that (keeping the subscriber balance constant) as the unused capacity of a

network increases, it has a greater incentive to reduce prices to utilise capacity. This may leads to an increase number of minutes of calling and higher traffic deficits.

The number of data points falls from 1312 to 131 as data on BTS's and spectrum is available only on a half yearly basis. The results are not conclusive. The regression of traffic balance against subscriber balance and BTS balance, yields a significant and negative coefficient on the BTS balance in line with our hypothesis. The regression of traffic balance against subscriber balance, BTS balance, and spectrum balance yields a significant and negative coefficient on the BTS balance in line with our hypothesis, but a significant and positive coefficient on spectrum balance, which is also an indicator of unused capacity.

One might believe that our results are skewed by the fact that prior to the 2008 licenses being issued the industry consisted of operators of roughly similar sizes, and these results would not be applicable in a situation where operator sizes are significantly different. However, while there may have been greater homogeneity between the operators at a national level, at the level of a circle, operators had very different subscriber numbers.

The data allows us to analyze the traffic balances of a sample operator with respect to every other operator, but does not allow us to take into consideration the traffic balances of other operators among each other. The study, therefore, may be skewed by the sample operator's unique competitive positioning, customer profile, and calling patterns. A data set with the balances of all other operators among each other would be above this reproach.

While the analysis looks at circle-wise data to understand the relationship between network size and traffic balance, it is important to remember that many operators are present across all circles. What is of relevance to such operators is their aggregate traffic balance across circles. Ideally therefore one would like to look at aggregate data on traffic balance and aggregate data on network size in order to derive the relationship. This may not be the same as the relationship at an intra-circle level. However, this is not possible due to the limited number of pan-India operators.

Further, the study of the relationship between traffic balance and the number of subscribers can only be a first step toward understanding the determinants of traffic balance in the Indian mobile industry. The next step is to regress traffic balance against the ultimate determinants, namely customer income profiles, pricing strategy, and calling patterns.